Contents

Section 1 Preamble

The guidelines are intended to provide additional information to teachers in interpreting the syllabus. The document is divided into eight sections. Because there is much more to teaching than the transmission of knowledge and skills, (Section 4), the other sections are intended to help teachers in the planning and organisation of their work.

Section 2 emphasises that the approach to the teaching of Technology may be different from that adopted in other subjects.

Section 3 endeavours to give some help in the use and organisation of the resources necessary for the teaching of Technology. This section does not give a list of the type or extent of the resources which a school should have to teach Technology. This will vary with the school. Further information can be obtained from the 'Resource Material for Junior Certificate Technology' already published by the Department of Education.

Section 4 forms the greater part of these guidelines. Expansion is given on the Knowledge And Skills section of the syllabus together with an indication of the total hours which might be given. The hours stated are not prescriptive and are intended only as a guide to teachers. It is not intended that these guidelines be used as a textbook either for teachers or students. Consequently no reference is given to the underlying theory. Teachers are recommended to consult other sources for such information.

It is accepted that the teaching of Technology is a complex activity and Section 5 offers some ideas on programme planning and organisation. If such planning and organisation is not undertaken the teaching in the classroom and specialist rooms will be ineffective.

Because of the emphasis on the doing of tasks by the students, Section 6 offers some advice on how to manage practical work.

As the student progresses through the course, the teacher will need to measure the students' performance. A few ideas are given in Section 7.

Section 8 is concerned with inculcating good practice in regard to safety and health at all times.

The guidelines conclude with a number of appendices.

Section 2 Teaching Approaches

Introduction

The syllabus emphasises the central role of the task. It will not be possible for students to undertake a complete task in the early stages of the programme. Their knowledge and skills will have to be built up in an ordered manner. The student's knowledge should be assessed at appropriate stages in the course by various means such as a written test in the form of completion or multiple choice or essay questions, or any combination of these.

In adopting a task oriented approach, care should be taken to build up student competency first. For this, early development of drawing and sketching skills are critical. In second and third years, while still introducing the knowledge and concepts in some areas, there should be a conscious effort to integrate as many of the syllabus sections as possible from earlier work so that the tasks being undertaken gradually become more open, integrated and extensive. The students will thus continuously revise and update their knowledge of those sections of the course already covered.

Following on the teaching of a knowledge-based or skills-based element of the course appropriate small-scale tasks could be undertaken which relate directly to, or are a consequence of, this element. On completion of the small-scale task, a foUow-up period could be used to reinforce and highlight the basic principles and knowledge involved.

Students should be encouraged to source information themselves and it is essential that a variety of reference books pertinent to Technology be available to them. Where such possibilities exist, students may be in a position to borrow reference books on a library system for homework. While the teacher is also an information resource for the student, he/she is not a source for all knowledge.

Planning

While there are various ways of teaching Technology, consideration must be given to elements of the syllabus that are fundamental to all of the topics covered in the course. These should form the starting point in the first year to provide the framework on which the student will build the learning of both knowledge and

skills. The basic elements of Communications and a foundation in Craft & Materials would be essential in this regard if the student is to progress confidently and with due regard for safety. Some areas from Energy and Control such as Mechanisms might need to be taught early in the programme. From the outset, the student should be aware of how Technology **and Society** interact.

Keeping in mind the requirement to integrate all the elements of the course rather than see each section as an entity in itself, a sample programme for First Year is given in Appendix A, where the tasks are selected to ensure the integration of the preceding content elements. The programme given is not definitive or prescriptive.

The planning of second and third years can follow a similar layout, going into greater detail and expanding the student's knowledge and skills appropriately.

Team Teaching

Because of the particular expertise of teachers in schools the possibility of providing for Technology by means of team teaching could be considered. This may take the form of individual teachers taking responsibility for particular sections of the syllabus. Another possibility is where more than one teacher might be timetabled for the Technology class at the same time. There could be advantages in this approach particularly when dealing with tasks being undertaken by the students.

Team teaching has a number of advantages to offer in the teaching of Technology. Apart from the broader base of expertise and teaching styles, the students tend to become more independent and self-reliant, viewing 'the teacher' less as the central figure. An important aspect of team teaching is the careful planning of roles and responsibilities for course content, etc. together with the integration demanded by the tasks. (cf. Section 3 - Resource Management) Care should be taken that the syllabus should not become compartmentalised or certain sections associated with individual teachers: rather the emphasis should be on the integration of the different sections of the syllabus so as to contribute more effectively to the undertaking of tasks.

Organising the Student

Students can be directed towards good organisation and practises if they are provided with structured approaches to any undertakings assigned to them. An example of this might be a prepared 'blank' workbook, setting out the stages expected to be followed or considered in the completion of an assignment. An example of such a workbook is given in Appendix B. Students learn from each other and opportunities can be planned for group discussion and 'brain-storming' sessions. There is also a lot to be gained from having time for a formal presentation after completion of main tasks. In this manner students will have an opportunity to broaden their perception and ideas on a variety of topics and gain an insight into how other people interpret situations. While there may be the danger that this will introduce unwanted competitiveness, it should not be dismissed lightly.

Teams of students can, on a rota basis, tidy up the Technology or other specialist room for any incoming class, without loss of time in another class. Since any one student will be called upon only occasionally, it is of slight inconvenience to them.

Students can also derive benefit from setting out, checking, and putting away common or shared items of equipment such as power packs, kits, stock supplies. Again, this can be operated on a team basis, and contribute to the development of an overall sense of responsibility for their own learning.

The Design Folder

No student should be allowed to commence manufacture without adequate planning. The design folder should contain a clear step by step plan for the manufacture of the item. Any rough sketches or notes produced by the student should also be included in the folder. Folders of written or printed material can be stored in a filing cabinet where they can be considered secure. The artefacts may occupy much-needed valuable space and can pose quite a problem.

Particular difficulties arise where a student's project or task entails the use of kit pieces or sub-assemblies that are needed for further tasks or investigations. In such circumstances, photographic or videotaped record of the item might be included with the folder indicating the precise use of these parts in the final product.

Extracts from student folders are given in Appendix C.

Section 3 Resource Management

Facilities & Equipment

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SAFETY

It is desirable that the space allocated to the teaching of Technology be designed so as to cater for a variety of activities such as material processing, graphics, task completion and storage. Care should be taken with the layout to minimise the effects of waste such as dust and fumes.

It is preferable that designated permanent space be provided for the teaching of Technology. Due to the broad nature of the syllabus content and the varied requirements in relation to practical work it is likely that teaching initially could involve the use of a number of rooms, e.g. Art Room, Computer Studies, Construction Studies Workshop, Home Economics Room, Library, Materials Technology(Wood) Workshop, Metalwork Room, Science Room, Technical Graphics/Drawing Room, Technology Room, etc. Available tools, access to equipment, power points, water and waste disposal provision have to be included in the planning for a year's work.

Careful planning of the timetable will be required if proper access to appropriate facilities is to be provided. It may be possible to cater for the availability of these specialist rooms on a rota basis, perhaps even on a term basis depending on the teaching approach being adopted - especially in the first year. Duplication of basic items of equipment may be inevitable in order to avoid having to simultaneously reserve a number of rooms for the teaching of Technology.

Time

The minimum time allocation for technology should be four periods per week timetabled as two double periods(approximately 240 hours). The recommended time for the various sections of the syllabus is included in Section 4 of these guidelines.

The vital resource of time must be managed with care. It must be pointed out that skill acquisition takes time and should be allowed for in planning the programme for any year. The greatest use of classroom time may occur in the design phase of the task for two main reasons.

1. The student, rightly, must spend time, unrushed, in contemplating a variety of solutions.

2. The elementary drawing skills required by the syllabus may result in very slow work in the preparation of working drawings.

Communications by clear drawings/sketches and reports is an essential part of the design process. Adequate time needs to be given to the acquisition of these communications skills. The students might find it useful to produce some of their drawings in their own time. The speed of preparation of working drawings can be greatly advanced by adopting some of the suggestions on freehand drawing proposed in the Communications section of the guidelines.

Cross-Curricular Links

Teachers of technology, if not familiar with, should at least be aware of the content of other parts of the school curriculum that might have a bearing on a student's understanding of, or progress in, specific elements of the technology course. The depth of treatment and timing of topics in these related areas might be taken into account when planning particular sequencing of learning in Technology. Some obvious examples occur in Materials Technology(Wood), Metalwork, Art, Craft and Design, Home Economics, Computer Studies and Science, but there may also be aspects of History, Geography, etc. which would be relevant.

Storage

Because there will be a need to assess the students' progress in terms of tasks, consideration will have to be given to the storage and/or display of their work, both during and after its completion. This can be a major problem where students undertake the construction and assembly of a sizeable artefact. Where the assessment is purely an internal matter for the teacher and students, short-term storage facilities are adequate (shelves and presses in the Technology Room for example). For purposes of external examination towards certification, a longer-term storage need arises.

Other Resources

Access to library, both school and community, should be included in the planning. Use of audiovisual equipment and photography, if available to the school, can be of great benefit in the teaching of Technology.

Section 4   Knowledge and Skills

This section expands on the syllabus content. It seeks to indicate more precisely what particular skills and knowledge should be taught. It seeks to place a limit on the extent of those **skills** and knowledge and 0fiefs examples of the kind of activities which could be undertaken in the classroom. The examples given should not be regarded as prescriptive but rather as indicators of the underlying thinking in the syllabus. Teachers will be able to add or substitute their own ideas.

Communications   (40 Hours)

Introduction

Good communication skills are crucial to a successfully executed task. In fact no task should be undertaken without first developing some of these skills. Each task at its inception is communicated as a situation or brief.

Communication skills will be drawn upon as the task proceeds through the different stages
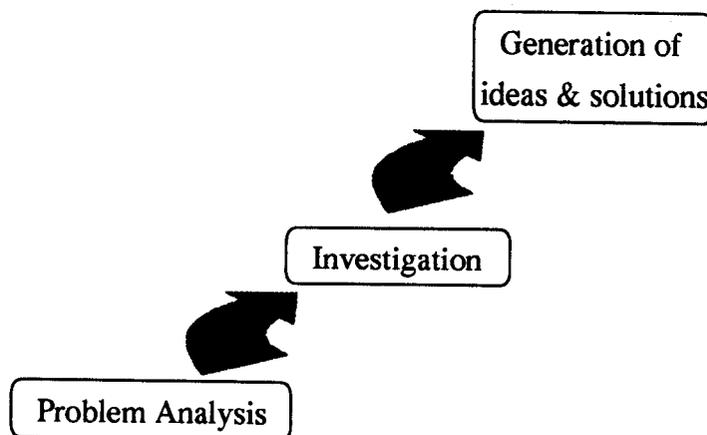
Basic instrument handling skills and simple orthographic *projection* and oblique or isometric projection should be the early target areas so that the student

- will develop a basic understanding of, and ability to produce, intelligible orthographic sketches and working drawings,

- will develop some appreciation of concepts such as accuracy, precision, and neatness, which are essential to the realisation of the task.

When a design solution has been identified, working drawings containing all the information necessary for the manufacture of the article are prepared, including

- cutting lists,

- component lists,

- tools required,

- processes required,

- skills to be acquired,

- sequential plan of execution,

- procedural sketches.

After the task has been realised it is evaluated and reported on. The evaluation asks questions such as:

- Is it safe?

- Does the solution fulfil the requirements of the brief?

- How could it be improved?

- Is it worth improving it ?

- Would a different choice of materials be better?

- Is it pleasant to look at ?

- Is it pleasant to handle?

The records of these activities are carefully kept and retained for reference.

Drawing Conventions

Graphics is an international language of communication and drawing convention is its grammar. There are various standards relating to working drawings, e.g. engineering drawing and building drawing. These standards govern types of lines for different uses, symbols for different materials, showing positions of drilled holes, showing dimensions, etc. Drawing conventions are also used in other areas, notably, f ~the purposes of Junior Technology, in electrics/electronics and pneumatics. In these two areas students need to be familiar with the representative symbols for the various components with which they might reasonably be expected to come in contact. Ref: Booklet BS PP7307

It is of great importance that these conventions be observed regardless of whether the drawing is produced in freehand, grid-aided freehand, or using instruments.

Scales

The fundamental ability to select a suitable scale for drawings and models and to state that scale (1:10, 2:1, etc.) fulfils the requirements. The application of a scaling system here can help students with the problem of maintaining ~oportion.

Sketching and Drawing

| Syllabus | Expansion | Notes and Comments |

Two Dimensions
(Freehand)

Expansion

The ability to produce simple two and three dimensional sketches that illustrate ideas, concepts and possible solutions in outline form, are expected and will be examined. The production of freehand drawings in good proportion on plain or grid paper could be used in advance of instrument drawings. Samples of suitable grids are given in Appendix D

Use of Instruments

Though the use of instruments is required by the syllabus, the choice of instruments is at the discretion of the teacher. It is advisable, however, that students gain experience using the tee square and set squares as a way of disciplining their approach and fostering the appreciation of neatness and accuracy in their work. The use of the computer should also be encouraged.

It is a perfectly valid option to produce drawings freehand. Grid assisted freehand on squared paper is probably the better option. This approach produces great economy in the management of time, is speedier than instrument drawing and is easier to assign for completion outside of class time.

Notes and Comments

Care should be taken that the grid paper selected suits the type of drawing produced. Students frequently **experience difficulties in this area.**

Useful small scale tasks that explore development and integrate most areas of the communications section may easily be devised. They would commonly be of the **'Design** a cut out, fold up, toy suitable **for including on** the **back of** a cereal packet' variety. This type of task integrates design with accurate drawing, development, use of colour, preparing sequential instructions and realisation in card.

Section 4 Knowledge and Skills

Technology Guidelines

Syllabus	Expansion	Notes and Comments

Two Dimensions
(Freehand) (contd)

Development

Development will be associated directly with, and is often included as part of, project working drawings. Students should be familiar with the development of the rectangular prism and cylinder.

Three Dimensions
~freehand or by other means)

The basic straight line skills of pictorial drawing should be taught early so that orthographic and pictorial drawings may be used in conjunction with one another throughout the course. The use of one to illustrate the other will greatly aid comprehension.

Perspective drawing need not be more advanced than two point perspective sketches. Examples are given in Appendix E

An introduction to the use of colour is also required.

Advanced instrument skills are not expected. Freehand drawing is acceptable for most purposes. The use of squared paper, isometric paper, templates for circles and ellipses etc. is recommended.

Simple rendering techniques should be taught, such as using a soft pencil to produce varying degrees of tone to represent shadow, using an eraser to produce highlights by removing areas of tone and using an underlay to rub on texturing.

The simplest techniques can prove highly effective. For example, using a coloured background to highlight a sketch is very effective and simply done. Coloured pencils are perfectly adequate for this task though water-colours, markers etc. may also be used.

Syllabus	Expansion	Notes and Comments
Schematic drawings and procedural sketches	Schematic drawings to represent systems and the use of symbols to represent the various components. Electronic, electrical and pneumatic circuits represented on paper as schematic drawings.	The relevant standards can be found in B.S.I. Booklet PP7307. It should be noted that some teachers may prefer to use the American symbols for the logic gates.

Examples of schematics in action which students should be aware of include bus and train routes, factory control boards, railway control consoles etc.

A series of sequential sketches to describe procedures to be followed as with D.I.Y. components and fittings. |

Syllabus	Expansion	Notes and Comments
Introduction to Computers	Students must be familiar with the correct start-up and shut-down procedures when using a computer and its accessories.	
	Input and Output Devices	Keyboard, mouse, disk drive/magnetic tape, (scanner, light pen, microphone) as input devices. Monitor, printer, disk drive/magnetic tape, (modem, plotter, speaker, games and/or other ports) as output devices.
	Filing Procedures • Ability to load and save files and programs and an awareness of the necessity of backing up files and programs. • Copying of files.	
Graphics	Use of the computer to generate graphic images for 'painting' or 'drawing' and an awareness of its potential in areas such as Computer-aided-design (CAD).	
Reports	Students should be aware of the potential presented by the computer for the editing, storage and retrieval of text and graphic images.	Students should be familiar with, and develop skills in relation to the use of, the keyboard and/or mouse for entering plain text and other characters.

Syllabus	Expansion	Notes and Comments
Models	The production of models should be regarded as an important part of the design process. At some stage during the investigation it may be necessary to test whether possible solutions are satisfactory or whether they function properly. The construction of a model can often help to pin-point faults in the construction and or operation of the design. The model can help to stimulate and promote new ideas and help to choose suitable ways of constructing the final design. Valuable time and money can often be saved if a design proves faulty at this stage instead of discovering problems during the realisation.	Modelling is a transition stage on the way to the final artefact, or system. Because it is transitory, a model should be as rudimentary as will suffice to clarify spatial, mechanical or other doubtful areas of the design. Materials therefore should be extremely manageable (paper, card, soft iron wire, cloth, clay etc.) to allow easy manipulation, and they should also be inexpensive since they may have to be disposable.
	There are several types of models. Consideration needs to be given to the one that is most suitable to the design in hand.	
	(1) Working mechanical models.	Working models are made in order to test whether moving and working parts of a design such as pulleys, gears, link mechanisms and pistons function properly within the area for which they have been designed. Model construction kits may be found useful here.
		Models can also be used to check whether parts of a design fit each other, either physically or visually.
	(2) Models to check shape and form.	

Syllabus	**Expansion**	**Notes and Comments**
Models (contd)	(3) Electrical or electronic model circuits.	To test whether an electrical or electronic circuit will operate as designed, electrical kits or bread-boarding can be used.
	(4) Small scale **models.**	Small scale models can often be made more quickly than full scale parts. Scale models economise in both time and materials and are of particular value when testing working parts or when judging whether a design fits with other features in a layout.
	(5) Full scale **models.**	The suitability of a design can often be tested using full scale models. Finished size and appearance can also be tested here.

Craft and Materials   (55 Hours)

Introduction

In a Technology programme a minimum level of skill development, process experience and materials processing are necessary before students can tackle worthwhile tasks with safety and confidence. All tools, machines and systems, carry with their use, varying degrees of danger to the user. It is essential that students be trained in the use of tools in a progressive manner and it is necessary that the student be given introductory exercises in skills development with tools, materials and processes. These exercises should have as their objectives the introduction to measuring and marking out tools, cutting tools and use of hand or power tools. The techniques of shaping, joining and assembling should also be introduced in these exercises

Once basic skills are acquired, other skills may be supplied to the student on a *need to know* basis, arising either from individual student need or from deliberate choice of brief, problem or situation by the teacher.

As plastic can be cut, shaped and formed relatively easily in comparison to other materials there is a danger that its use could become over emphasised. This would not allow students to experience a wide range of materials as the syllabus suggests.

The safety considerations in using plastics and indeed its environmental effects (disposability) should have an influence on its overall use.

Students must be made aware of the safety precautions required when using glues and proper protective clothing should be worn at all times.

Syllabus	Expansion	Notes and Comments
Properties	An understanding of the properties of materials at the microscopic level is not required. Every material has a unique set of properties. In order to work with materials an understanding of these properties is necessary and may be learned through working with the different materials and evaluation of completed tasks.	Appendix G gives a table of the common forms, uses and classification of a variety of materials.

An understanding of the properties of materials at the microscopic level is not required. Every material has a unique set of properties. In order to work with materials an understanding of these properties is necessary and may be learned through working with the different materials and evaluation of completed tasks.

Students will be expected to have worked with some or all of the following materials: wood, plastic, metal, fabric, composites, ceramics.

It might be necessary to investigate the suitability of a chosen material for a particular task.

The following properties should be considered:

- strength
- malleability
- toughness
- brittleness
- elasticity
- plasticity
- conductivity (electrical and heat)
- chemical breakdown.

Students should be aware of the general classification of materials, e.g. hardwood, ferrous metals, etc.

Syllabus	Expansion	Notes and Comments

Syllabus

Measuring and Marking out

Cutting

!

SAFETY

Expansion

Measuring

Use of rules, callipers, verniers and micrometers etc.

Marking out

Use of squares, gauges, scribers, dividers, and chalks etc.

Students should acquire the skills to cut materials accurately and safely. Time must be spent in demonstrating the correct operation, use and care of the commonly used tools and safety must be a priority.

Cutting Metal

Tin snips can be used for cutting light gauge sheet materials. A junior hacksaw is useful for thinner metal and lighter tasks. A guillotine may be necessary if using heavy sheet materials

Cutting Plastics

The cutting technique used for plastics will depend upon the type of plastic being used. Equipment required will range from knives, snips and saws to hot wire cutter for expanded polystyrene.

Cutting Wood

Various types of saws can be used, but for small sectioned wood tenon, dovetail and coping saws are the most appropriate to use.

Notes and Comments

It will be important for students to develop the correct skills that will allow the successful transfer of working drawings to the required materials. The measuring and marking out equipment used will depend upon the material in use.

Students should become familiar with the practical safety measures in the operation and use of hand and power tools and accessories, have a knowledge of the proper work-holding techniques, vices, clamps etc., and have an appreciation of the terms *speed and feed*.

Skroll saw, band saw and hand power tools can also be used when available but priority should lie with the simpler tools.

A skroll saw with a selection of suitable blades would prove particularly useful when working with acrylic materials. A band saw may also be used. Files can be used for shaping hard plastics and the skills developed for metals can also be applied here.

Skroll saws and jig saws can be used for curved work on timber and composite boards. Knives can be used to cut adhesive veneers and balsa wood.

Syllabus	Expansion	Notes and Comments

Syllabus

Shaping

!

SAFETY

Expansion

Shaping usually involves the removal of material in small amounts with special tools designed for the purpose

Shaping Metals

Students should

- become familiar with the selection, use and safety of files;
- develop the skills of cross filing, draw filing, concave filing, convex filing and understand their application.

Other tools to be made available:

- abrafiles, rasps, sheet abrasives.
- percussion tools: mallets, hammers, centrepunches etc.

Notes and Comments

For the purpose of the course in technology the following material sizes should be available to students:

- light gauge sheet metal in a variety of materials, copper, brass, steel and aluminium etc.;
- strip material of the above prepared from sheet material in suitable sizes
- round material available in a variety of materials ranging from diameter 3mm to diameter 20mm.

Files are used for shaping and smoothing metal. The hacksaw removes metal quickly but leaves a ragged edge. Files can be used to smooth the edge exactly to a line.

The use of the centre lathe if available can produce an extensive range of components and students should familiarise themselves with the use and safety of this machine.

Syllabus	Expansion	Notes and Comments

Syllabus

Shaping (contd)

Expansion

Shaping Plastics

Many of the methods used for the shaping of wood and metal can also be used with plastics. The method used will depend on the type of plastic being used.

The methods of forming thermoplastics in school workshops are

- line bending
- vacuumforming
- press moulding
- memory technique

Students should be aware of these techniques and experience them if possible.

Shaping Wood

Wood planes of various types and sizes are available but a smoothing plane would best suit this course.

Chisels also come in various types and sizes, but for general use, the firmer and bevel edge should be used.

The use of surforms and the some simple power tools, stand drill, jig saw and reciprocating sander should also be considered.

Notes and Comments

Polyester resin that comes as a thick liquid and whert mixed with a "hardener" or "accelerator" sets into a htard plastic material. This plastic is suitable for gravity casting and can be used to introduce students to the area of mould design and casting.

Some carving chisels may be used in tasks e.g. *"Design and make a house name-plate"*.

Syllabus	Expansion	Notes and Comments
Shaping (contd)	**Fabrics**	A sewing machine that has facilities for straight stitching, zig-zag stitching and an automatic buttonhole will satisfy most of the needs of the technology programme.
	The shaping of fabrics is usually an integral part of the design.	
	The common tools include scissors, sewing machines, needles and thread.	Knitting machines and looms might be used where available.
		A small over-locker would save time and is particularly useful for the beginner.
		Schools should be aware that more sophisticated machines now exist to allow patterns, names etc. to be added. There is a link here with the graphics section of the syllabus.
		Patterns and templates can be made from grid paper, newspaper or grease proof paper.
	Ironing and pressing are essential for working with fabrics.	Iron-on hemming and fabric glue will also be useful.

Syllabus	Expansion	Notes and Comments

Syllabus

Joining and
assembling

Expansion

Joining Metals

Metals can be joined by means of riveting, soldering,
folding, fasteners and adhesives.

Basic wood **joining techniques**

Students should be aware of the following basic wood
joining methods for use in design tasks:

- butt-joint where glue or adhesive or fasteners may be
used;

- housed and halving;

- doweling.

The various methods of joining materials apart from those
already mentioned are nails, screws (wood and machine)
bolts, pop-rivets, sewing (machine), soldering and
adhesives.

Notes and Comments

Students should have an understanding of the implications
of grain direction when designing tasks.

Section 4   Knowledge and Skills   **Technology Guidelines**

Syllabus	**Expansion**	Notes and Comments

Joining and assembling (contd)

Joining plastics

Students should be aware that

- plastics particularly acrylic can be joined to wood and metal using nuts and bolts and screws,

- acrylic can be fixed to a softer plastic like PVC with self tapping screws,

- acrylic is usually fixed to acrylic using glue such as epoxy resin or tensol cement.

Joining Fabrics

By means of sewing, adhesives and stapling.

Joining Multimaterials

Use of fasteners, adhesives and staples.

| Syllabus | Expansion | Notes and Comments |

Finishing of materials

The proper finishing of materials should be considered as this will play an important part in the completed task.

A good finish is required, not only for preservation but also for aesthetic purposes.

Finishing Metal

Plastic dip coating on steels may be used. Copper and brass are usually simply polished and lacquered.

Enamelling and etching might also be considered as well as painting metals such as aluminium or steel. The type of finish will depend on the task.

Finishing Wood

Various grades of sandpaper and sanding blocks are required. Finishes that may be used include oil, Polyurethane, paints and stains.

Preservatives may be needed particularly for outside use.

Finishing Plastics

These may be polished. Some are resistant to weather and usually require no protective coating.

Appliqu6 might be considered here.

Finishing Fabrics

This usually consists of dyeing, water proofing, printing and embroidery.

Energy and Control   (55 Hours)

Introduction

This section of the syllabus deals with the use and transformation of energy to achieve solutions to practical problems. This section should not be treated to the same depth as in a science lesson. It is important that students be able to understand the principles and use of various machines and components so as to be able to include them in the design of solutions to tasks. Care should be taken however to use the proper units and symbols associated with this section.

Students should be able to identify the use of mechanisms in everyday situations and recognise and describe the types of motion and motion change involved.

As an example of the possible integration of Structures, Mechanisms and Technology & Society, the bicycle could form the basis of an assignment.

Syllabus	Expansion	Notes and Comments
Energy	Recognition of the following forms of energy: mechanical, chemical, electrical, heat, light and sound.	
	Energy as the ability to do work i.e. cause movement	
	Devices that convert energy from one form to another, described as simple input-output systems using block diagrams.	
	Energy cannot be created or destroyed, it can only be changed from one form to another.	

ISyllabus	Expansion	Notes and Comments

ISyllabus

Energy (contd.)

Energy (contd)

Expansion

Conversion

Conversion of energy by devices e.g.

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┌─────────┐          ┌──────────┐
│ Sound   │   ───▶   │Electrical│
│ Energy  │          │ Energy   │
└─────────┘          └──────────┘
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Microphone

Units of Energy and Power

Energy is measured in joules (J)

Power is the rate of using energy, measured in watts (W), kilowatts (kW) or megawatts(MW). Many devices will have the power rating indicated.

Energy Conservation

Notes and Comments

The electric motor, loudspeaker, light bulb, dynamo, turbine, pump, windmill etc. can be used as the basis of study of energy conversions.

Electrical energy is sold by the E.S.B. in units of kilowatt-hour (kWhr)

Students should know that, while energy itself is conserved, the sources of energy in its different forms do not remain constant. This is a useful opportunity to deal with such aspects of Technology & Society as energy sources, the environment, conservation, pollution, safety & health.

Students should be able to identify renewable and non-renewable sources of energy.

Syllabus	Expansion	Notes and Comments
Structures	A structure is an assembly or arrangement of members of selected materials, arranged in a manner that maintains its general shape under load.	
	Unit of force - the newton(N).	
	Identification of the various types of forces acting on a structure. Types such as	Students should be able to recognise common structures in everyday use and identify the force(s) present.
	tension,	Student will need to consider the nature and properties
	compression,	of the material being used in a structure, and such
	bending,	aspects as safety, function, aesthetics, etc.
	shear,	
	torsion etc.,	
	with examples that clearly illustrate their differences as used in span, strut, tie.	The student will need to appreciate the need for stability, rigidity and equilibrium.
	Role of triangulation.	Suggested task:
		Construct a structure to span a gap of 2 m and hoM up a load of 2 N.
		The materials to be used could also be specified so as to close the task.

Syllabus	Expansion	Notes and Comments
Mechanisms	A mechanical device is made up of one or more mechanisms which shape and transform motion and force.	
Types of motion and motion change	Different types of motion: linear, rotary, oscillatory, reciprocating.	Investigation, classifying and describing different types of motion as evidence by trolley, gears, shafts etc.
	Transmission of motion	Students should be able to recognise the common mechanisms in everyday use (bicycle, blender, washing machine etc.) and recognise the types of motion involved.
	• linear to rotary and vice versa	
	• rotary to rotary;	
	• rotary to reciprocating and vice versa;	
	• oscillatory to rotary and vice versa.	

Syllabus	Expansion	Notes and Comments
Mechanisms (contd.)	Application of Mechanisms	
	Lever	Mechanical advantage in different types of levers (calculations not required).
	levers as linkages	
	Screw	
	Screw (also nut & bolt) as a means of rotary to linear conversion and vice versa.	
	Pulley	
	Fixed pulley to change direction of motion; simple applications	
	Others	
	Belts and chains, gears used in the transmission and transformation of energy and motion;	Not all mechanisms need be studied.
	Clutch used to facilitate the safe meshing/unmeshing of gears in transmission of power.	Suggested task:
	Effects of friction and need for lubrication.	*Construct a mechanism to lift a load of l O N through a height of 2 m*

Syllabus	Expansion	Notes and Comments
Electric Circuits	Flow of charge from one point to another in a circuit.	Only conventional current need be considered Students should note that polarity is important for some circuit components Charge flows in one direction only when a DC power source is used.
	Direct Current Electric Current (/) Unit of current, ampere [A]. Measurement; use of ammeter.	
	Voltage (Potential Difference) (V) The 'driving' force that causes charge to flow. Unit of voltage, volt [V]; measurement of voltage; voltmeter.	Use of an electric current to include heating, lighting, sound (as in speaker, buzzer), magnetic (as in relay coil) and movement (motor).
	Resistance (R) Unit of resistance ohm [~2] Colour coding of resistors. Measurement of resistance. Ohm's Law $V = I \times R$ Circuits	Resistors; fixed, variable, light dependent resistor, thermistor. Simple examples of applications of series and parallel circuits. Potential divider in this context for fixed and variable resistances. Parallel circuits.

Syllabus	Expansion	Notes and Comments
Electric Circuits (contd.)	Fault finding by simple test for continuity and measurement of voltage.	The multimeter can be very useful for this activity.
	Circuit Components	
	Switches	Automatic switching circuits as appropriate.
	Use of switches (simple on/off, pressure, reed, single and double pole, single and double throw, relay).	
	Other Devices	
	Bulbs, buzzers, relays, LDR, thermistor, resistors (including potentiometer as variable resistance)	Suggested task:
	Diode, LED, capacitor, transistor.	*Construct a toy for a small child that lights up and makes a noise.*

Syllabus	Expansion	Notes and Comments

Syllabus

Electronic Systems

Expansion

Simple electronic systems are to be treated as in the following diagram.

```
┌─────────┐      ┌─────────┐      ┌─────────┐
│  input  │ ──▶  │ process │ ──▶  │ output  │
└─────────┘      └─────────┘      └─────────┘
```
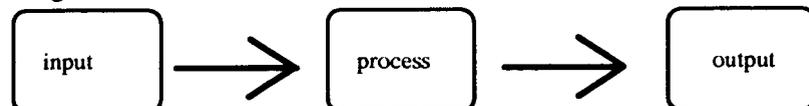
System Input

System Process
Decision circuits

Notes and Comments

The systems approach to electronics is recommended here. The understanding of the exact working of each component is not required. Students should have a knowledge of discrete components from their work in assembling circuits.

Input sensors to include switch; light (light dependant resistor, LDR), heat (thermistor), potential divider, etc.

AND, OR, NOT, NAND logic gates

The following symbols which are not B.S. symbols may be used.

AND   OR

NOT   NAND
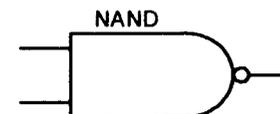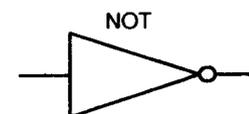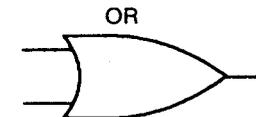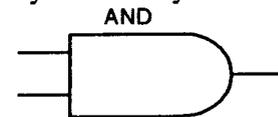
(Teachers maflfind it more convenient to use integrated circuits (IC) when using these circuits.)

Syllabus	Expansion	Notes and Comments
Electronic Systems (contd)	Amplification, switching and time delay circuits	Transistor as switch, amplifier;
		Capacitor as a time delay device in circuits.
	System Output	Buzzer, lamp, relay, motor or any electrical device which can give a sensory output in the form of light, sound heat or motion.
! SAFETY	Assembly & use of systems	Assembly of circuits using 'breadboards', commercial prototyping boards or even wooden blocks should be undertaken by the students. A variety of ways of assembling permanent circuits including insertion into prepared boards, soldering onto track boards or soldering onto prepared printed circuit boards. (It is not intended that students should be required to make the printed circuit beards).
		Many of the tasks already listed allow electronic solutions.

Section 4   Knowledge and Skills   Technology **Guidelines**

Syllabus	Expansion	Notes and Comments
Pneumatics	Pneumatics seen as a simple system: compressor, valve, cylinder.	Commercial pneumatic units for use in school are the most suitable
(These topics may be used by students in arriving at the solution of tasks, but will not form the basis of questions on examination papers.)	Use of compressed air as a source of energy.	Great care must be taken with any source of compressed air.
	Units of pressure: pascal [Pa] or BAR	Reference should be made to the use of pneumatics in industry.
	Use of three port (3PV) and five port (SPV) valves to control single and double acting cylinders, providing linear motion.	
	Use of restrictor to achieve time delay.	

!
SAFETY

Syllabus	Expansion	Notes and Comments
Robotics	Simple robotic control	Use of simple linkages and motors to achieve limited automation as in door openers etc. Use of time clocks or other controlled switching to achieve more complex control involving a number of stages or devices.
(These topics may be used by students in arriving at the solution of tasks, but will not form the basis of questions on examination papers.)	Computer Control	Use of output port of computer for control of electrically operated devices. Various commercial units are available that allow simple instructions to be entered The computer as the 'process' stage in a system. Computer input by means of programming or by use of supplied software. System output in the form of light, sound, movement, switching, etc.

Technology and Society   (15 Hours)

This section of the course is central to the identity of the subject. It invites the student to understand and constructively evaluate the role of Technology in society, to value the good and bad that it brings to our lives past, present and to come. It establishes the context within which to understand the practical work that forms the main focus of the coursework.

Some possible headings for the teaching of this section.

History	Where have our society and our technology come from? How has Technology developed through the ages? How have different societies down the centuries used their technologies, and to what ends?
Applications	How do we use technology in out" society? What ends does it serve? Who benefits and who does not?
Technology and Social~Cultural Development	This heading will draw students to question and understand the influences that determine the development of technology. These should include a simple understanding of factors such **as:**

- economics
- pure research
- military
- **ethics**

The discussion of ethics must also include issues such as the automation of production processes that results in redundancy for the workers who used to operate those processes. What is the acceptable price of progress? Similar questions might be asked about the role of entertainment in our lives. What is the impact of television, video, computer games, and soon, virtual reality systems with applications in simulations, games, training ete?

Limitations   It is important that students understand the limitations of technology, from the physical limits of particular materials and processes to the limits we may care to impose on technology for social, health, cost and other reasons.

Integration

The teaching of the Technology and Society element of the course should be integrated into the ongoing work insofar as this is possible. Thus it may be appropriate to discuss the further dimensions of an issue when it arises in the teaching. When, for example, plastic is first being introduced as a material it would be appropriate to explore

the history of its development

- its social impact
  (How have plastics changed our lives for better and worse?)

- its economic impact,
  (Plastics generally require high volume production to be economically viable).

Co-operation is another essential skill that should be explicitly addressed in the teaching of technology. Co-operation is a normal practice in modern industry. Modern technology is now so sophisticated that it is dependent on the skills of numerous people working in close co-operation for its success. Students could experience the benefits and the difficulties of co-operation when undertaking an extensive task which requires input from different students for various parts.

It is necessarily difficult to quantify the resources required for the teaching of the Technology and Society element of the course. Resource needs will be dictated by the nature of the study undertaken by each teacher. It would be useful for each school to have a small library of reference books for teacher and student use. Such a library might include relevant encyclopaedia, technology dictionaries and reference books and perhaps relevant journals.

A most valuable resource is the work of the students themselves. It is well worth collecting the best student work from each assignment and storing it in a school library for later use and reference. This resource is most valuable in motivating other students as it can be used to set and raise the standard of work expected. Indeed one of the first tasks to be undertaken by the class might be to design a storage system suitable for the students work.

Task Suggestions in Technology and Society

The following list of suggestions is by no means exhaustive and should be added to by teachers as often as possible. The tasks can be identified under different headings:

- i n t r o d u c t o r y tasks,
  introducing the student to the breadth and scope of technology;

- o v e r v i e w tasks,
  intended to bring the student to an understanding of a broad
  area of technology;

- detailed tasks,
  intended to take the student to an in depth understanding of a
  specific issue;

- c h o i c e tasks,
  allowing the student to research a topic or area of their own
  choosing.

(This may happen to coincide with a hobby interest or involvement in a competition such as the Aer Lingus Young Scientist.)

Thoughtshould be given to ensure that effective learning takes place during such task work. It is worth considering a variety of modes of presentation. With the regular paper submission, students might be asked to give a 5 minute verbal presentation to the class on the key concept of their study. This could be done with the added support of audio visual media, posters, overhead transparencies, video etc.

Some examples may help to clarify the previous points.

Example Tasks

1st. Year Technology Task: The Domestic Appliance

Brief:

Choose one domestic appliance and prepare a report on it under the following headings:

(i) General introduction

(ii) Description including diagram(s) drawn by yourself

    photos are optional

    identify materials used

    method of construction

    technologies used (mechanical / electrical / electronic etc.)

(iii) Operation

    What does it do? How does it do it

(iv) Safety

    Identify specific safety features of the appliance and explain their purpose and operation.

(v) Design

    Comment on use of eolour for style, fashion and function

    ergonomic aspects of design

    hygiene

(vi) Problems and difficulties.

    Faults, defects in operation of appliance and some suggestions for how these might be overcome.

(vii) Conclusions

The report is to be submitted on A4 sheet paper, bound in a simple manila folder, or better.

Students are expected to show evidence of personal effort by way of research etc.

Each student will submit an individual report, though group work is active~, encouraged during the research stage.

2nd. Year Technology Task: Energy Transformation
Brief:

Examine one energy source under the following headings:

(i) composition - origin

    - location and method of extraction / processing for use.

    - chemical formula / principal ingredients.

(ii) method of use -choose one specific method of use

    - use diagrams drawn by yourself.

    - explain energy conversions implicit in usage of chosen fuel.

(iii) wastage

    - identify principal sources and causes of energy wastage.

(iv) solutions

    - suggestions to reduce/eliminate energy wastage identified in (iii) above.

The emphasis in this task will be on detailed and extensive research. Students will be advised on reference sources as appropriate.

Students are expected to develop and show understanding of the concepts of energy, energy conversion, energy efficiency and energy conservation.

Students must include their own diagrams as appropriate. They may include photos as optional. Each student will include an individual report on A4 paper, bound in a simple manila folder or better. Students are encouraged to share study and research sources and work.

2nd Year Technology Task: Technology and a Changing Society

Introduction:

Technology is central to the lives we live today. While changes occur quickly, they may be taken for granted. Television and radio for example seem to have been around for ever. This is not so. Television is barely 30 years old in Ireland; radio less than 70 years old. This task will ask you to select one major change which technology has brought about in the life of our society.

Brief:

Choose one appliance, service or process of technology. Find out how people coped before and after its invention or introduction. Comment on the impact it has had on society. Use the following headings in the presentation of your work:

(i)   Introduction:

Outline briefly the subject of your study and the layout of your report.

(ii)   Before:

Describe the life people led before the introduction of the subject of your study. Show specifically how they coped before the new development was introduced.

(iii) The appliance, service or process..

Describe in detail. Refer to its development, how it works, what it was intended to do, etc. Use maps and diagrams etc. as necessary.

(iv)   After:

Describe how people lived after the introduction of the subject of your study. Show specifically how they coped after the new development was introduced. Focus on how their lives changed.

(v)   Comment:

Summarise the good points and bad points of the change brought on by technology.

On balance is society better off as a result of this technological change?

The emphasis in this task will be on detailed and extensive researehi Students will be advised on reference sources as appropriate.

Students are expected to develop and show understanding of the impact of technology on society;: for good and for ill and to evaluate the relative merits of such change.

Students must include their o,~n diagrams as appropriate. They may include photos us optional.

Each student will include an individual report on A4 paper, bound in a simple manila folder or better. Students are encouraged to share stud), and research sources and work.

3rd Year Technology Task: Problems and Harm For Society

Introduction:

Technology is central to the lives we live today. We depend on it for the quality of our lives. We take it for granted. Unfortunately technology can sometimes cause problems for us, even harm to us and our environment. In this project you will be asked to explore in some detail some of the issues involved in the problems and harm caused by technology.

Brief:

Choose one example of a problem or of harm caused by technology to society. 'You may focus on environmental issues (pollution, waste disposal etc~) or on social issues (abuses of technology e.g. substance abuse; displacement of people by technology). Your study should explore the problem or harm, its cause, its nature, its consequences and some of the solutions for dealing with it.

Your report should be prepared under the following headings:

Introduction:

Briefly state the issue you are going to discuss and outline its causes, nature, and effects.

The problem:

Describe fully the problem/harm. Focus on one specific example or case history. Describe its cost in social, environmental, health, financial, etc. terms. This section should include facts, figures, charts, maps or diagrams as relevant.

The causes:

Examine the causes in detail. You should show the context from which the problem arises. (Generally technological developments are well intentioned):. ~The negative results may be side effects, unforeseen effects, effects of negligence etc.

The solutions:

This section should deal with solutions to the problem as detailed above. Some solutions may be already in force. Others may be possible though not in force for various reasons. Examine these reasons.

Comment:

Add your own comment. Is the problem/harm an acceptable price for progress? To what extent is it avoidable? What more can be done, and by whom?

The emphasis in this task will be on detailed and extensive research. Students will be advised on **reference sources** as appropriate.

Students are expected to develop and show understanding of the impact of technology on society, for good and for ill and to evaluate the relative merits of Such change.

Students must include their own diagrams as appropriate: They may include photos as optional

Each student will include an individual report on A4 paper, bound in a simple maniia foider or better. Students are encouraged to share study and research sources and work.

Section 5 - Programme Planning and Organisation

Tasks

Teaching through Tasks

Teaching through tasks provides the opportunity for the student to acquire the knowledge and the skills at the same time and to a depth that is determined by their own level of understanding and ability. While there is a need for some basic knowledge input, the student can, through judiciously chosen tasks, add to this knowledge while developing skills in a 'hands-on' approach across a wide spectrum of topics either individually, as would be the case in the initial stages of the course, or in a more integrated fashion - once the initial knowledge and skills have been established in a number of different areas.

The task-based approach is founded on the principle that technology education should reveal the process of technology as it evolves from ideas to final product. Initially teachers may have some difficulty in adopting this approach which is fundamental to technology. There may be a reluctance to let students 'have a go'. Teachers should try not to discourage students' suggestions but rather should allow them to find out the limitations themselves. There will be times when the teacher will have to intervene in the interests of safety, economy, etc.

The 'problem centred' approach creates an environment within which the student becomes an active and interested learner. New levels of enthusiasm can be engendered in the students as their desire for new knowledge and new skills increases. Significant long-term benefits have been identified with this approach to tasks. These include

- students develop improved levels of research and enquiry skills;

- students learn the skill of decision making and their capability for making intelligent choices is enhanced;

- the need for personal management of activities is fostered through organisation and planning of work and the adherence to time schedules;

- new capabilities of presentation skills, oral, written, graphic and visual **are** imparted to students;

- students' ability to make reasoned and informed **evaluation** of their" own work is greatly improved.

It is important that Tasks be brought to completion and then evaluated.

The object may not necessarily be an artefact; it could be, for example, a computer program. In any case it must be the *considered solution to **the task** set*

It is expected that teachers provide a broad range of tasks for their students to undertake. The aim should be to enable students to undertake a variety of tasks that involve the use of as wide a range of skills and knowledge. It would be a very limited treatment of Technology if students were confined to tasks requiring **the** use of certain materials, or indeed to tasks requiring the use of certain materials only.

It would be incorrect to expect that all tasks will result in new and innovative outcomes. Students will have to be taught to use existing technological artefacts and systems, to modify and adapt them to the task in hand and even to evaluate existing solutions.

Over-ambitious tasks lead to time wasting, disappointment and.frustration. The task undertaken should be achievable with existing skills and only such additional iskills as can realistically be gained in the time scale. Ideally each succeeding task should build on and reinforce skills and knowledge already gained. Selecting suitable tasks is not so much a problem of coming up with ideasfor projects as it is of matching student ability, resources, and time, to provide the optimum learning outcome.

An open design briefgiven to veryjunior students will result in chaos. Early design briefs should be closed down very carefully to direct students towards the targeted learning experience. As students grow in their design ability and maturity, the design briefs may gradually be made more open allowing the student more freedom of expression. Due to resource constraints all task brie3~ will be closed to some extent. Great care must be taken in the formulation of the design brief(f the above targets are to be met. Loopholes that would allow wild and unachievable design forays should be foreseen and written out of the brief.

Tasks should be of such duration that interest does not wane before completion. Time allowed will vary with complexity and student ability but it is important that a realistic deadline be set. A task taking an entire term to execute is too long. Ideally the life of a major task should not exceed eight weeks with six weeks being a likely optimum

Task   Selection

In first year at least, students are still dependent on concrete experiences in their learning, only gradually making the transition to more abstract concepts. The 'investigation and research' stage of the design cycle are likely to be confined to specific examples of existing artefacts, etc. which they can recall. Only later will they become more innovative and creative in their approach to designing solutions to problems or indeed in identifying problems to which they will apply themselves in designing solutions.

In selecting tasks, therefore, this level of development must be borne in mind and tasks that, of themselves, develop or highlight particular skills or aspects of technology, while at the same time laying the groundwork for a more expanded or complex approach at a later stage, need to be chosen. The 'small-scale task' concept can be a basis for a more integrated task to follow. For example, an investigation of gear Wains in mechanisms, allied to the setting up of a simple electric circuit in which a motor can be switched on/off, and the design and manufacture of a suitable body or frame in craft & materials, can b e integrated into a task in which it is required to design, make and test a motorised vehicle that travels at a specified speed. This can be made more extensive if the vehicle must be capable of automatic control and/or manoeuvrable in some manner.

When selecting tasks of an open integrated nature, particularly at the initial stages, it may be helpful to select from an area the student is familiar with - home, school, hobbies being some examples. The teacher could present them with a situation and brief, but then gradually encourage students to find their own situations with problems that need solving. This approach will require students to formulate their own brief thus allowing a wider base for solutions.

To achieve a progression from directed tasks, students must develop within themselves the ability to recognise and define their own situations/problems. Obviously the level achieved will depend upon student ability.

Time   Allocation

The time allowed for the completion of the task must take into account the possible 'bottle-necks' that may arise in the need for certain items of equipment and the consequent delay introduced. There also arises the question of whether students should be allowed to take incomplete artefacts home with them for completion on their own time. It is worth giving consideration to different forms of presentation for the tasks and in this regard oral presentation to their peers provides an opportunity for interpersonal communication skills that should not be overlooked. It will take extra time if all the students are to take this approach on the one task - perhaps a better idea is to spread this across a number of small-scale tasks by way of introducing it and set down a root for oral presentations of main tasks/projects.

The time allocated tor the completion of tasks will be dependent on the stage reached by the students and the level of integration demanded. The small scale tasks referred to above might be adequately catered for by one class period, where the students prepare their report as a homework exercise or are presented with a 'task sheet' or workbook in which they can record their observations, designs and conclusions etc. If they are expected to present a printed report, or there is need for extensive research or communications (graphics), obviously more time will be needed. The important feature of the time allocated is that it must be reasonable but definite. Part of the students' development through technology involves organisation and planning of time just as much as equipment and processes.

In order to encourage the organisation of their work along the lines of the design cycle, it is to be recommended that first year students be given prepared sheets or a booklet in which they can record their ideas and sketches and develop one of these, with an evaluation completing their report. The use of grid paper, both square grid paper and isometric grid paper, is to be recommended from the beginning until such time as the students have mastered basic skills in relation to graphical representation. As students make progress and develop their own skills, it should be possible for them to design their own folders that could, for instance, integrate both computer-generated and freehand graphics.

Evaluation and Assessment

Another factor to be borne in mind when planning or assigning tasks is the advisability of making the students aware of the criteria against which the tasks will be assessed and any weighting that will be applied. This will help them to organise their time in relation to the various requirements of the task.

The evaluation stage is vital if the student is to reflect on experience, assimilate what has been learned and uses this in the planning of new experiences. The evaluation and reflection could take the form of homework in which the student, having completed a task, considers how this might lead to other applications or projects. As has been stressed already, this forms an integral part of reporting on any task or project. An assessment scheme, even for the small scale tasks, must reflect the part played by evaluation at the final stage in the process even though observation, analysis and revision are ongoing throughout the task.

Initially, the briefs given to the students will tend to be specific since their purpose is to establish particular knowledge and skills as a stepping stone in enabling the students to apply this developed body of knowledge and skills to more complex situations. In time, students should be challenged to interpret a given situation and write a brief themselves, stating clearly the constraints that apply and identifying the specific aspects that will form the basis for research and investigation. There is also a requirement that there should be a progression towards open, extensive and integrated tasks that strike a balance between the different content areas of the syllabus, keeping in mind the need for safety and the limitations of resources. Particularly at third year level, students (and teachers!) must not lose sight of these considerations when devising tasks.

Reference has already been made to homework in the context of evaluation and indeed research or investigation. One of the difficulties that arise with regard to tasks and homework is the element of uncertainty that it introduces with regard to the work being the student's own. In some instances, students may have access at home to equipment and facilities that the school is not capable of providing, as well as expertise in particular areas that would relate well to technology. It could be required that students work on their tasks, especially the realisation stage, within class time and use home study to reflect on and reinforce their knowledge of the principles and applications etc. associated with the task.

For the purpose of evaluation and assessment,

teacher involvement in the task should maintain a

necessary balance between

- guidance and direction

- student creativity and problem solving.

Section 6 - Management of Practical Work

The nature of the practical work undertaken in Technology is such that often a range of activities is being carried out at the same time. The emphasis must be on the 'active learning' aspect of this approach and take into account that there is need for explicit teaching of both knowledge and skills at all levels. The extent to which this explicit teaching is required may be determined by such factors as the nature of the task being undertaken, the prior experience or stage of development of the pupil, demands of safety, etc.

To manage the students in this 'active learning' role entails an element of trust that they must establish with the teacher by which they are given maximum freedom for the 'hands-on' experience, subject to the over-riding requirements of safety and classroom order. This is necessary if the teacher is to be in a position to assist and direct individual students who may need more explicit teaching of skills than others. Once that element of trust has been established, both teacher and students are free to get on with the tasks in hand. The teacher is free to give more direct attention to an individual or group - a resource that is available to the students as they undertake their tasks.

In regard to individual or group work, it must be borne in mind that each student is endeavouring to develop knowledge and skills through Technology education, and this will require that the emphasis be on students individually undertaking practical work as often as feasible, particularly where new skills are concerned.

Where the thrust of a particular task is on the integration of different areas of the syllabus content and is based on skills already established, group work can be beneficial in reducing the time spent as a class in completing the task and avoiding 'bottle-necks' in relation to specific equipment. It also has the advantage that ideas are shared and discussed before a chosen solution is developed and this can encourage critical and observational skills that might not otherwise be called upon. In this situation, responsibility for individual aspects of the task could thereafter be shared out among the group members so that simultaneously a number of the stages could be in hand. As mentioned in relation to the progression from small scale tasks to integrated tasks where there are distinct elements from a number of syllabus sections, these could be shared out, especially at the realisation stage in the cycle. Meanwhile one member of the group could be in the process of compiling the report on behalf of the whole group.

care must n et a g e nu m t all s t u d e n t shave approximately e q u a l exposure to all types of activity.

As the students progress to more open tasks, there will be demands on different facilities and equipment. The teacher must be in a position to advise and direct students with regard to the level of complexity of a task they undertake.

Students must not be allowed to work in specialist rooms or use specialist equipment unless they are familiar with all safety procedures and there is a teacher competent in the use of that equipment in the room.

SAFETY

The preparation of materials in advance and careful advance planning of the work sequences by the teacher is vital to the smooth running of the practical work sessions. Bottle-necks should be anticipated and planned out by allowing a number of different processes to take place simultaneously in different groups and locations. Tools should have clearly defined storage locations and 'return when finished' should be an inviolable rule.

Section 7 - Measuring Student Progress

Students should be assessed both on their knowledge acquired and on their skill competence.

Assessment of Knowledge

Assessment may be achieved in relation to the knowledge element of the course by oral questioning, short-answer or multiple-choice questions, or by essay questions. Multiple-choice questions, especially where a bank of questions has been developed for a variety of sections of the course content, provides a quick method of assessing specific areas of knowledge in a short space of time. When blocks of these questions are used together, they can provide a very efficient and objective assessment of a broad spectrum of the knowledge content. The language structure of this type of testing must be suited to the students' ability level and the fact that such tests can be re-administered means that the teacher can quickly assess progress achieved since the last testing on the same area(s).

Completion type questions can be used to encourage the students to develop research skills, particularly where these are assigned in conjunction with texts or reference books in a classroom situation. They can also form the basis of a wide testing of material since the time devoted to any one specific question is relatively short.

Essay questions tend to suit an in-depth testing of the students' knowledge in specific areas and, because of the length of time required in answering one question, may restrict the breadth of the assessment. They do, however, provide the opportunity for creativity and flair in speeialised areas.

Assessment of Skills

Assessment of skills can be achieved by close observation of procedures adopted by students, paying particular attention to their observation of proper safety procedures. Some teachers may decide to compose an assessment of skills examination during the programme to assess the progress of the students and **to** provide feedback for remedial action. Clearly, the completed tasks provide ample scope for the assessment of skills as evidence by the design folder and the

completed artefact. The criteria for such assessment should be communicated to the students when they are beginning the task, keeping in mind the weighting of the syllabus objectives and the extent to which this weighting can be applied to the design cycle stages.

A sample task assessment sheet is included in Appendix G. Teachers may find this useful or may wish to adapt it for their own particular requirements.

The scheme consists of six areas for assessment with appropriate mark weightings as follows:

AREA	Mark
BRIEF	6
RESEARCH	15
SOLUTIONS	15
DEVELOPMENT	9
MANUFACTURE	40
EVALUATION	15

Section 8 - Safety and Health

Protective clothing and equipment must be available beside all equipment that is likely to present a safety hazard (goggles, gloves, etc.) and the teacher must insist on such protective gear being worn when the equipment is being used (as well as wearing it himself/herself)

A basic set of safety rules should be drawn up for all working in Technology rooms. These should be clearly displayed in each room and a copy given to each student.

Because of the practical nature of Technology and the manner in which classes operate with a variety of individual and group activities, it is essential that teachers be familiar with the general rules of safety applicable in the school as a whole and in the specialist rooms in particular. The school safety statement is a good starting point for dealing with the issue. Students must develop an awareness of the hazards associated with multiple activities, and also with the use of specialised equipment. All hazards associated with equipment used in Technology rooms should be identified and appropriate precautions enforced.

The rooms in use for Technology should be fitted with equipment necessary to cope with likely hazards such as fire, gas leakage, electric shock, cuts, etc. Convenient isolation switches should be provided for power. There should also be access to washing facilities convenient to the Technology or specialist rooms. Students generally should be made aware of the correct fire drill in operation and the correct procedure to follow in the event of any other foreseeable hazard occurring. Hazardous equipment not in immediate use should be removed from the immediate working area. Strict rules should be attached to the use of equipment that is potentially dangerous where 'bottle-necks' occur (strip heater, soldering iron, boiling water, bubble etch tank, etc. as examples).

The Technology Room is likely to contain chemicals which students may handle and use. Flux for example is a corrosive paste that should not be allowed into skin contact. Epoxy resin adhesives are dangerous

chemicals that must be handled with care. The common 'super glues' should be treated with particular caution.

Acrylic cement adhesives are highly volatile, they should be used in well ventilated conditions and not in the vicinity of naked flames. Ventilation is also necessary where a number of students are engaged in soldering over a period of time in order to disperse the vapour.

Hand tools also require care and disciplined handling. Carrying tools while moving about should be disallowed. The single most important requirement for the safe use of hand and power tools is to understand how to use them properly. Thorough instruction and careful demonstration by the teacher are essential.

Students should be encouraged to read and understand the manufacturers' instructions and to recognise and understand the various international symbols used to warn the user about the properties of a product.

Dangerous machines such as drill presses, scroll, band saws, and strip heaters must be carefully supervised.

Basic rules such as

- **No Loose Clothes,**

- **No Loose Ties,**

- **Long Hair should be restrained,**

- **Always Wear Eye Protection**

- **Adequate ventilation**

should be insisted on to the point of being habitually observed.

Appendix A   Example Year 1 Programme

Communications	Craft & Materials	Energy & Control	Technology & Society	Task
Sketching and drawing in two dimensions; three-dimensional isometric drawings using grid and freehand; Use of reference sources.	Properties of a range of common materials; safe handling and correct use of basic hand tools appropriate to tasks; Simple treatment of process to include: • cutting, • forming, • shaping • finishing.		This can be integrated into the aspects treated already or follow on from them.	Task No. 1 Key ring or desk tidy
Reports; Elementary computer applications.		Forms of energy and its conversion; energy conservation; Simple structures including triangulation of forces.	Developments and implications in relation to the areas already covered.	Task No. 2 Bridges on spans or towers
	Selection of materials; assembly and joining methods; Bending and drilling.	Mechanisms; Energy and motion.	Historical perspective and significance .	Task No. 3 Lifting device or vehicle
Conventions used in diagrams of electric circuits; interpretation of circuit diagrams;	Properties of materials in relation to electricity and safety; Assembly of components in circuit construction.	Simple treatment of electric circuits using basic components; Electronic Systems introduced using commercial kits.	Electricity in the home; safe use of electricity; Applications and implications.	Task No.4 A task incorporating controlled motion using switches or sensors.

Appendix B Workbook (example)

Workbooks could be organised along the following lines:

Evaluation

Plan of Manufacture

Working Drawings

Ideas and Possible Solutions

Investigation

Problem Analysis

Design Brief

Problem
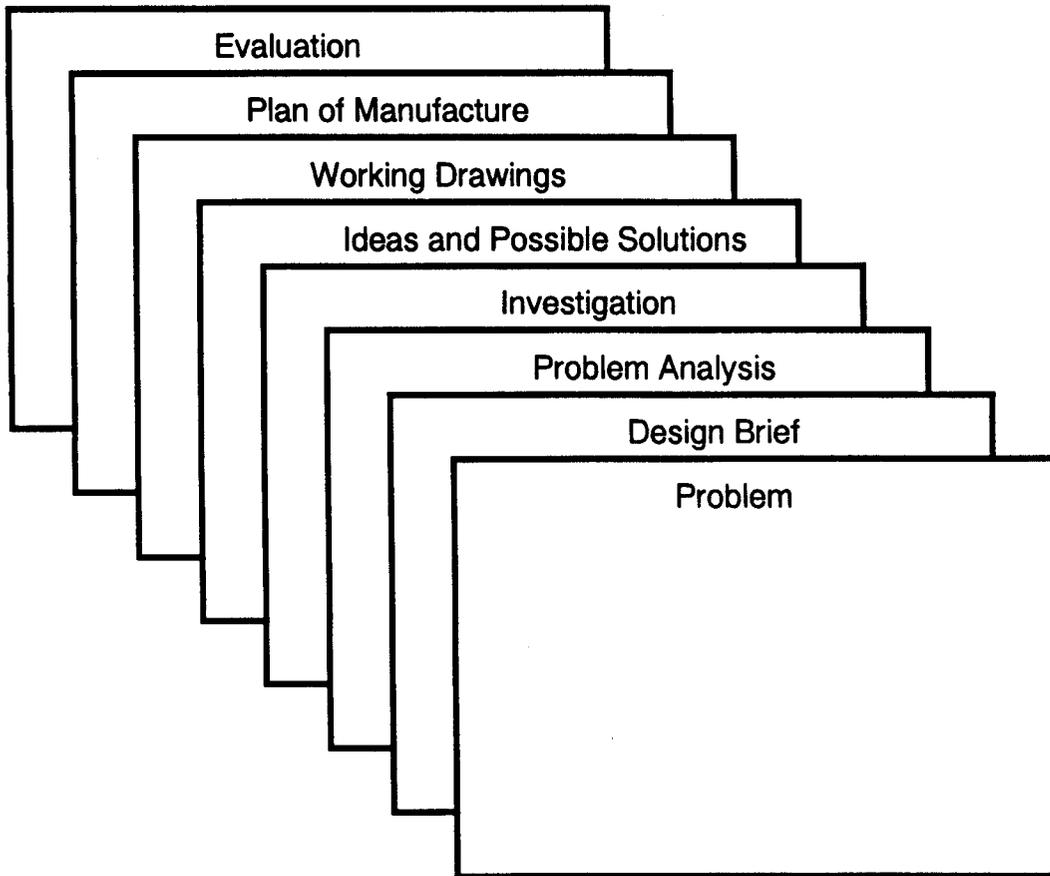
Appendix C Extracts from student folders

30cm
10cm
t bcm

PIVOT
PIN

ELEVATION

END ELEVATION

PLAN
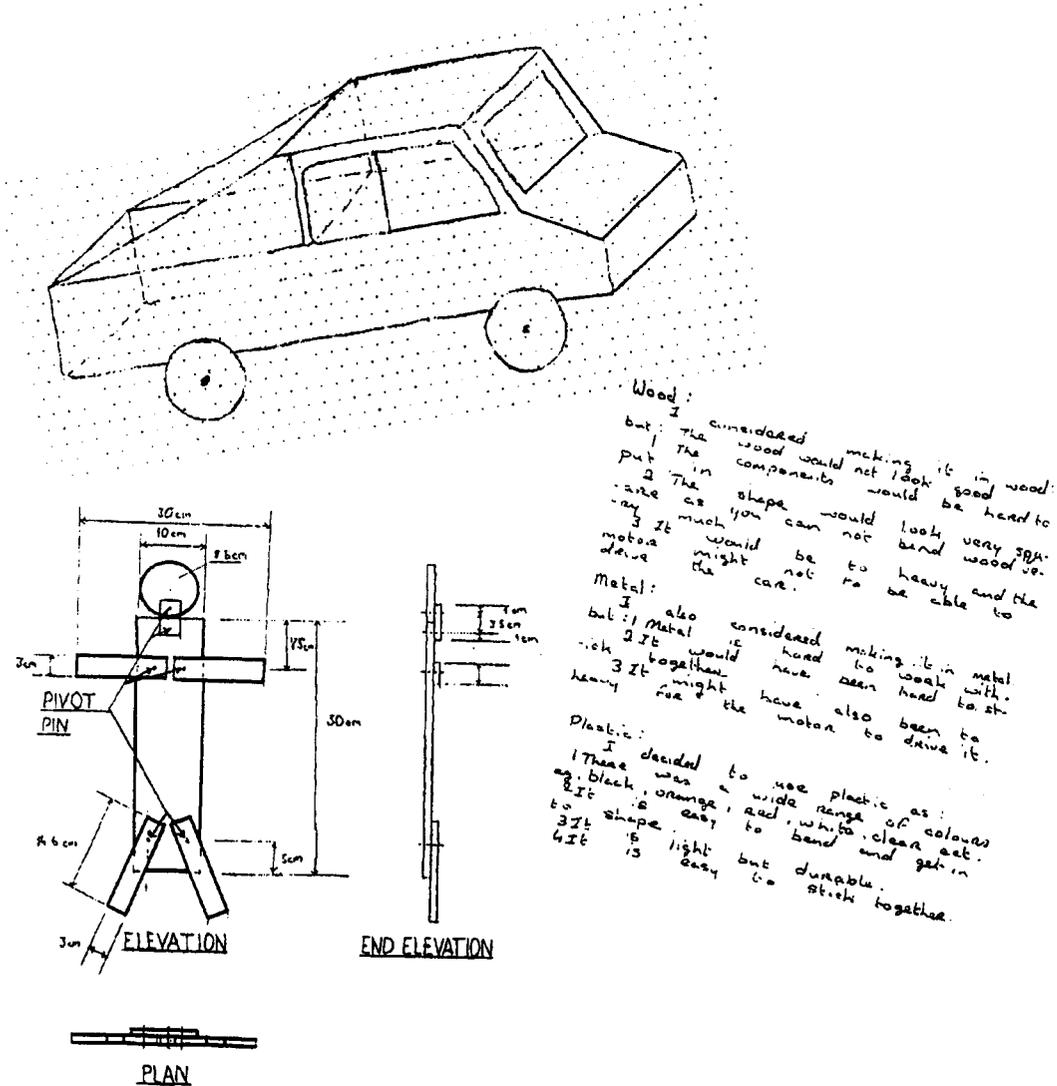
IDEAS :~ SOLUTIONS

As I have already stated ea~'l~, I had to use NON TOXIN GLUE
known as BOSTIC. Thc gluc had to bc NON TOXIN so as not to
poison the young child The glue had to be used on the top of the
lever so if the child was playing the nuts would not fall off. Also
another problem was the edges of the mobile were to sharp for a
child t.o pl~,y with. Trmmded the sides with a ronnd file, so it. would
be safe and have no more sharp edges.

I used two strings of twine. One string attached from one arm to the
oUmr. IL ~vas Ulen brought down Lied m tile centre, and tile sLf'mg was
then let hang for the child to pull. The other string was brought from
leg Lo leg. ~len Lied as the arms and was leL hang down. The child
therefore had a choice as to which string .he or she could pull. The
arms and legs would then move up and down I made the body of the
mobilc out of red plastic. Thc Icgs and arms wcrc madc of rcd
plactic with a lever at the tops of them and had a little hole just about
it for the thwinc to go through.

Appendix D Grid

Square Grid

SQUARE GRID

Appendices Technology Guidelines
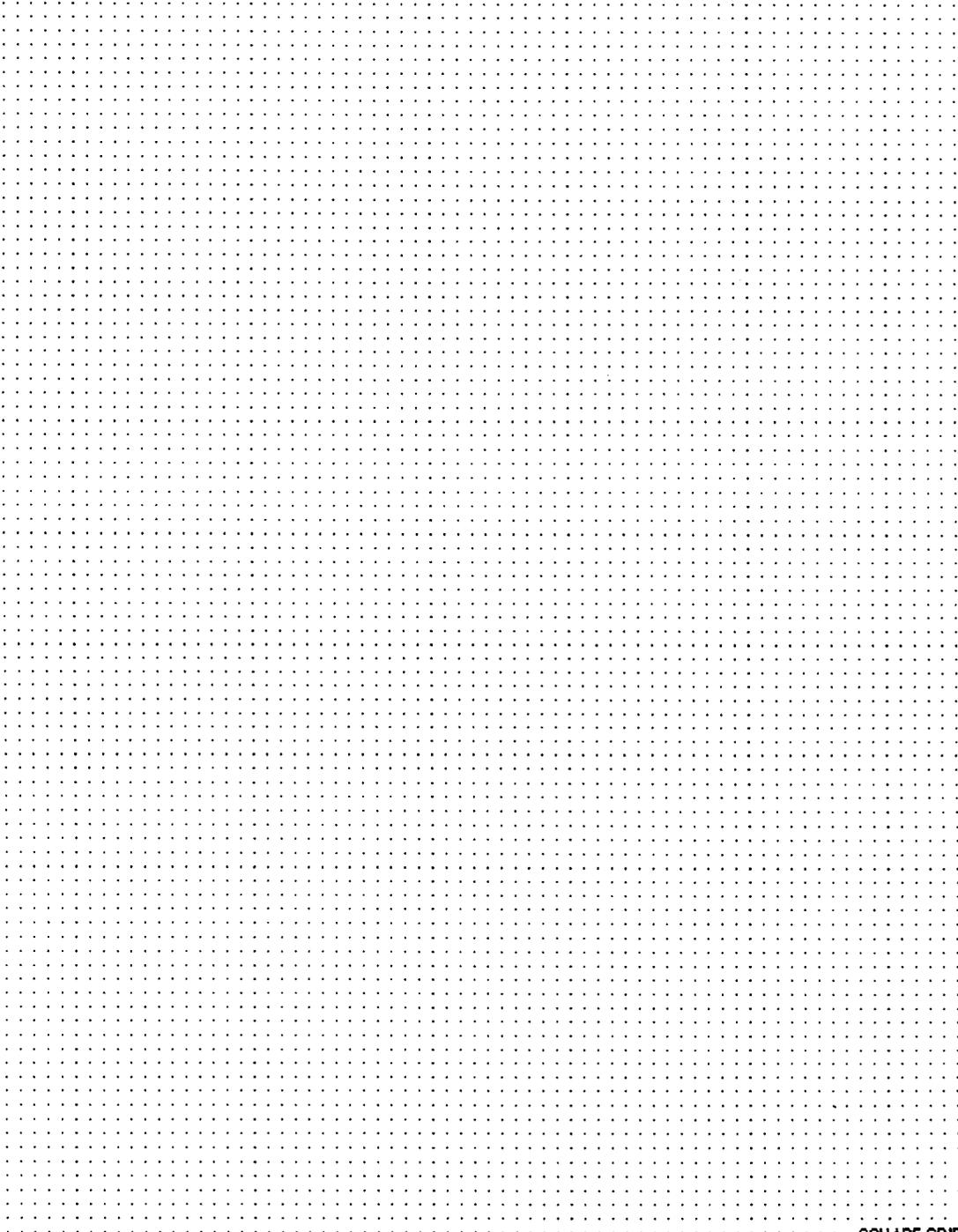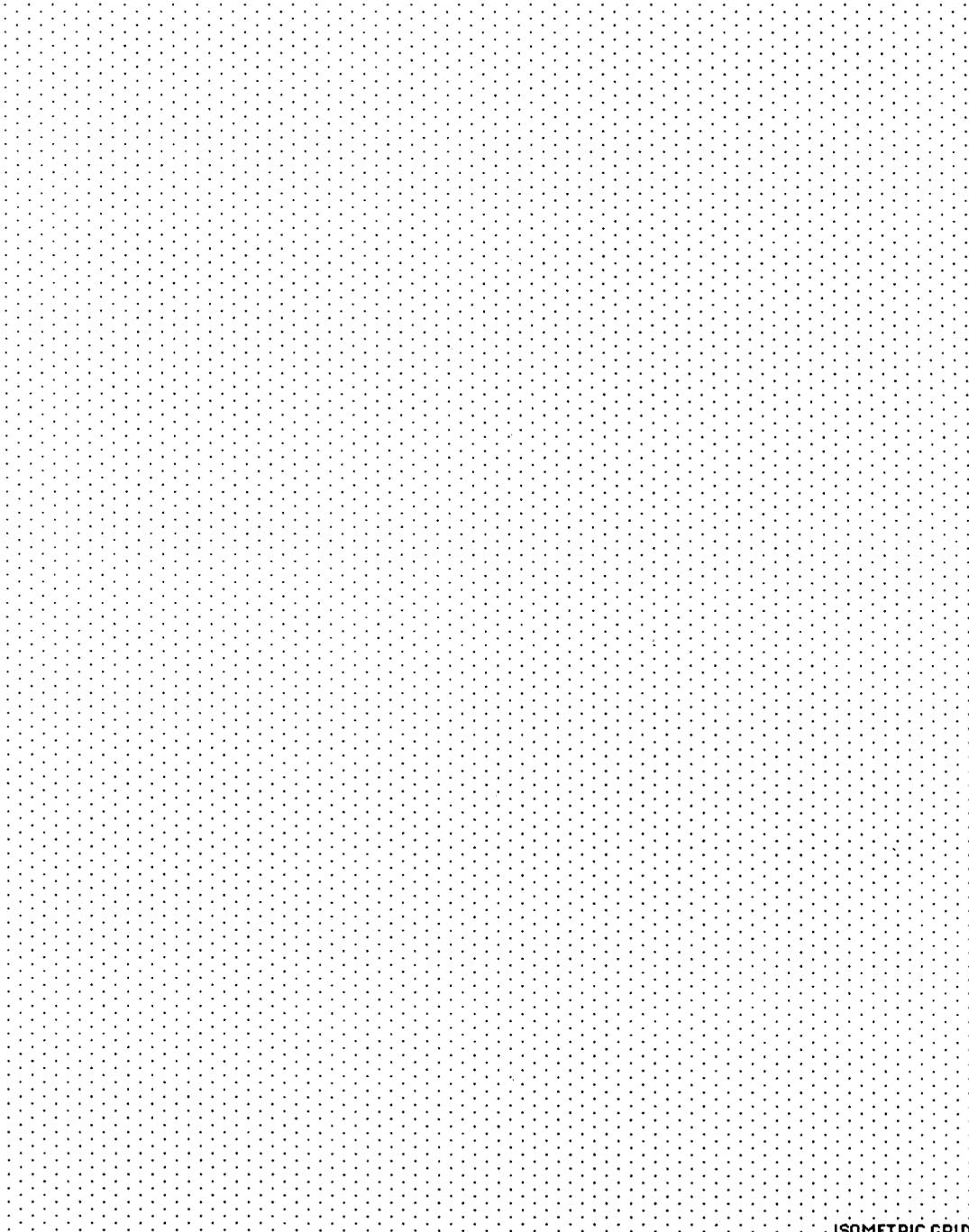
Isometric Grid

ISOMETRIC GRID

Appendix E Perspective Drawing

vp   Horizon line   vp

Horizon line
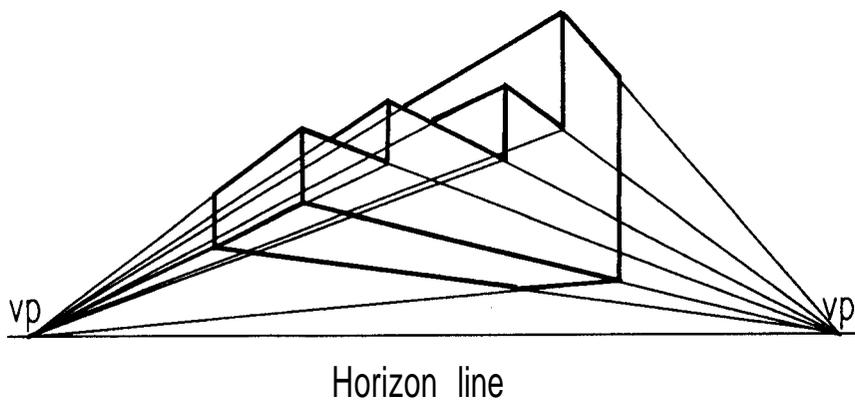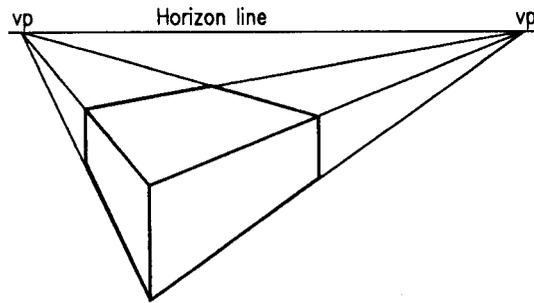
Appendix F Materials

Metals

Metal	Properties	Common Forms
Aluminium	Light, soft, ductile, conducts heat and electricity	bar, rod sheet, tube, angle.
Copper	malleable, ductile and tough, conducts heat and electricity, resists corrosion	bar, rod sheet, tube
Brass	resists corrosion, casts well, good conductor, can be work hardened	bar, rod sheet, tube, angle, ingot
Mild steel	high strength, ductile, tough, low cost	bar, rod, sheet, tube, angle, wire, nuts and bolts.
High carbon steel	very hard but less ductile, can be hardened and tempered	small bars rod and strip
Tin plate	strong and ductile, resists corrosion	sheeto~y
Soft solder	soft, low melting point, easily joined to other metals	wire or bar

Plastics

Plastic	Properties	Common Forms
Low density polythene	range of colours, insulator, flexible and soft, resists chemicals	powders, granules, sheet and film
High density polythene	range of colours, stiff and hard, easily moulded	powders, granules, sheet and film
Rigid **PVC**	range of colours, tough, stiff and hard	powders, granules, sheet and extrusions
Expanded polystyrene	light, insulator, absorbs shock	sheet and beads
Acrylic	stiff, hard, clear or opaque, range of colours, good insulator, bent and formed easily	sheet rod and tube
Nylon	hard, tough, wear resistant, self lubricating	powder, chips, rod tube, sheet
Polyester resin	stiff, hard, brittle	liquids and pastes
Epoxy resin	good insulator, good adhesive	powder, **paste**

Woods

Wood	Properties	Common Uses
Red and white deal	soft, easily worked, straight grained, finishes well	inside joinery, low cost construction
Mahogany	takes good finish, strong, medium weight	furniture, veneers, plywood
Teak	takes good finish, strong, medium weight	furniture, veneers, plywood
Balsa	very light, easily cut and glued, takes paint poorly	light structures, modelling, prototype case building
Birch plywood	strong, easily painted	covering box frames, large flat surfaces
Marine plywood	strong, waterproof, expensive	boats, exterior use
Chipboard	low cost, veneer or melamine faced, interior use	flooring, interior furniture
Blockboard	very strong	strong box making

Manufactured Fabrics

Type	Properties
Regenerated	
Acetate	resists mildew, shrinking, gains and stretching
Rayon	absorbent, easy to launder, dries easily
Synthetic	
Acrylic	soft, resists mildew, sunlight and wrinkling
Glass	resists chemicals, flames, mildew moisture and sunlight
Nylon	Strong, elastic, easy to launder, dries quickly, retains shape
Polyester	resists wrinkling, easy to launder, dries quickly
Rubber	strong, elastic, repels moisture
Animal Fibres	
Wool	good insulator, elastic, sheds creases, absorbs moisture, shrinks easily
Silk	warm, very strong, elastic, damaged by perspiration
Vegetable Fibres	
Cotton	strong, easily washed, creases easily, absorbs moisture, dyes and bleaches well, burns easily
Linen	strong, dirt-resistant, absorbent, cool, difficult to dye, shrinks considerably.

Appendix G Sample Task Assessment Sheet

Task Assessment Sheet

NAME: Class:

       Task Title

	Range	Marks
BRIEF		
(a) No brief stated	0	
(b) Simple statement of problem/brief	1-3	
(c) Clear and detailed statement	4-6	
RESEARCH		
(a) No evidence of investigation	0	
(b) Minimum approach; aspects ignored	1-5	
(c) Good investigation of all aspects	6-10	
(d) Complete analysis and research	11-15	
SOLUTIONS		
(a) None considered	0	
(b) Only one solution used/presented	1-5	
(c) Two solutions in fair detail	6-10	
(d) Three or more solutions, full detail	11-15	
DEVELOPMENT		
(a) No development presented	0	
(b) Simple attempt at development	1-3	
(c) Good development/detail omitted	4-6	
(d) Full details; reason for final choice	7-9	
MANUFACTURE		
(a) Not submitted	0	
(b) Simple construction/little skill	1-10	
(c) Good workmanship/many skills	11-20	
(d) Wide range of skills; good standard	21-30	
(e) High degree of skill/workmanship	31-40	
EVALUATION		
(a) None undertaken at any stage	0	
(b) Poorly thought out/imprecise	1-5	
(e) Good evaluation and critical review	6-10	
(d) Thorough evaluation; suggestions given for alternatives/future work	11-15	
TOTAL MARKS	100	

       Adapted from W. Lynch C.B.S. Oatlands, Dublin

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